



# PATENT SPECIFICATION

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## APPARATUS FOR USE IN SURGERY

The invention relates to an apparatus and method for use in surgery and in particular to an apparatus and method to be used in minimally invasive surgery in which surgery is carried out by making the smallest  
5 incision possible in a patient's body generally referred to as laparoscopic surgery.

Abdominal surgery is generally carried out by making a relatively large incision allowing a surgeon  
10 to enter the body cavity with both hands. Such surgery is traumatic for the patient and the healing process is lengthy. Some laparoscopic surgery such as hernia operations may be carried out by surgeons using minimally invasive techniques with trocar assemblies.  
15 However, the techniques are generally complex and difficult and are not widely used.

According to the invention there is provided an apparatus for use in surgery comprising a sleeve having  
20 an entry opening and an exit opening;

a first sealing means for sealing the exit opening around an incised wound of a patient;

a second sealing means for sealing the entry opening so as to enable a controlled environment within  
25 the sleeve to be maintained in use.

In a particularly preferred embodiment of the invention the sleeve comprises a generally cylindrical device closed at one end thereof and the exit opening  
30 is provided in a side wall of the sleeve adjacent to the closed end.

In one arrangement the exit sealing means comprises a flange around the exit for sealing against the body of a patient. Attached to the flange is a further sleeve with a ring member attached thereto  
5 which is insertable into an abdominal cavity. The ring member creates a seal to prevent escape of gas from the body cavity. Preferably the flange is provided with an adhesive for adhering to the body. Typically the flange is covered by a peel-off cover.

10

The entry sealing means may comprise a valve means through which a surgeon's arm may be inserted or through which a surgical instrument may be passed. Preferably the valve means is of a material which is  
15 sufficiently flexible to allow an arm to be passed therethrough and to seal against the arm when passed therethrough.

In one embodiment of the invention the entry  
20 sealing means comprises a first sealing element provided in the entry opening and a second sealing element provided on a surgical glove, the sealing elements inter-engaging to seal the sleeve of the glove on passing of the glove through the entry opening; the  
25 second flange providing a further sealing means.

The apparatus also provides a pressure differential means.

30 The invention will be more clearly understood from the following description thereof, given by way of example only with reference to the accompanying drawings in which:-

FIGURE 1 is a plan view of a first embodiment of an apparatus according to the invention;

5      FIGURE 2 is a cross-sectional view of the apparatus of Figure 1 of the drawings;

10      FIGURE 3 is a plan view of a second embodiment of an apparatus with an entry sealing means in position;

FIGURE 4 is a perspective view of the apparatus of Figure 3 in use;

15      FIGURE 5 is a perspective view of the entry sealing means of Figures 3 and 4 of the drawings in a first position of use;

20      FIGURE 6 is a side elevational view of the entry sealing means of Figure 5 of the drawings in an intermediate position of use;

25      FIGURE 7 is a perspective view of the sealing means of Figure 5 of the drawings in a second position of use;

FIGURE 8 is a perspective view of a third embodiment of an apparatus according to the invention;

30      FIGURE 9 is a side cross-sectional view of a fourth embodiment of an apparatus according to the invention;

35      FIGURE 10 is a perspective view of a fifth embodiment of an apparatus according to the invention in use;

FIGURE 11 is a plan view of the apparatus of Figure 10 of the drawings;

FIGURE 12 is a cross-sectional view of the apparatus of Figure 10 of the drawings shown in use; and

FIGURE 13 is a cross-section view of the apparatus of Figure 10 of the drawings shown in use.

Referring now to the drawings and in particular to Figs. 1 and 2, there is shown an apparatus 1 which comprises a sleeve 2 of flexible gas-impermeable material. The sleeve 2 comprises a generally cylindrical body closed at one end 3 thereof and open at the other end 4. At the end 4 is defined an entry opening 14 for enabling a surgeon's hand or surgical instrument to be introduced into the sleeve 2. Near the end 3 is provided an exit opening 5 having a flexible flange 11 disposed coaxially relative thereto. The flange 11 is in sealing engagement with the sleeve 2 the exposed face of the flange 11 having a suitable adhesive material 10 thereon protected by a peel-to-remove protective cover 12 thereon.

Referring now to Figures 3-7 of the drawings, there is shown a second embodiment of an apparatus 100 according to the invention which is similar in construction to the apparatus 1 except as follows. Integral with end 4, there is provided an entry sealing means 20. The sealing means 20 comprises a first flange member 21 and a second flange member 22 interconnected by a flexible material which forms a cuff 23.

Referring now to Figure 8 of the drawings, there is shown a third embodiment of an apparatus 50 according to the invention which is similar in construction to the apparatus 10 except as follows.

5 Integral with the end 4 is a first flange member 51. A surgeon's type glove or surgical glove 53 is provided having a second flange member 52 integral therewith in the region of the open end of the glove 53. Upon insertion of the glove 53 through the end 4, the  
10 flanges 51, 52 are interengageable in a manner which will be described later in the specification.

Referring now to Figure 9 of the drawings, there is shown a fourth embodiment of an apparatus 60  
15 according to the invention which is similar in construction to the apparatus 50 of Figure 8 of the drawings except as follows. A protector means 61 comprises an inner ring 63 and an outer ring 64 connected by a tube 62. The rings 63 and 64 are  
20 integral with the tube 62 being located at respective ends thereof. Insertable into the exit opening 5 is the protector means 61.

The material of the tube 61 is the same type as  
25 that of the rest of the sleeve 2.

Referring now to Figures 10-14 of the drawings, there is shown a fifth embodiment of an apparatus 200 according to the invention. The apparatus 200  
30 comprises a sleeve 202. The sleeve 202 comprises a generally cylindrical body having a first end 203 thereof and a second end 204 thereof.

Near the end 203 is provided an exit opening 205 having a flange 211 disposed coaxially relative thereto. The flange 211 is in sealing engagement with the sleeve 202 the exposed face 213 of the flange 211 having a suitable adhesive material thereon protected by a peel-to-remove protective cover 212 thereon.

Within the sleeve 202, there is provided a second sleeve 232. The second sleeve also comprises a generally cylindrical body having a first end 233 and a second end 234.

The second sleeve 232 has sides or seams 236 and 237 which are in sealing engagement with the inner wall of the sleeve 202. In addition, the second end 204 of the sleeve 202 is in sealing engagement with the outer wall of the second sleeve 232 at a seam 241.

At the end 234 is defined an entry opening 214 for enabling a surgeon's hand 253 or surgical instrument to be introduced into the sleeve 232. Integral with the entry opening 234 is a flange element 220 which incorporates a cuff 221 similar to the cuff 20.

The first end 233 has an opening 238 which is of sufficient size to enable a hand to pass through. The opening 238 stops short of the location of the opening 214 and is preferably located approximately mid-way between the opening 214 and the opening 205.

Adjacent the opening 205 is provided an aperture 244 which is in communication with a tube 245. The tube 245 is disposed within the sleeve 202 and terminates in an opening 246 externally of the cuff 221. Through the side wall of the sleeve 202, a spur

tube 247 passes which is in communication with the tube 245.

5           The operation of the various embodiments will now be described.

          With reference to Figs. 1-7 of the drawings the device 1 or device 100 is used as follows.

10           An incision is first made in the abdomen 31 of a patient. The peritoneum is not cut. The wound is haemostatically secured. An incise drape is applied to the abdomen. An opening is made in the drape. The cover 12 is removed and the flange 11 adhesively bonded  
15           to the drape around the incision so that the incision is in register with the opening 5. If a hand is now inserted through the opening 14, access to the incision in the abdomen 31 can now be achieved via the opening 5. The peritoneum is now cut and the interior of the  
20           sleeve 2 is in communication with the interior of the abdomen 31. Because the wrist of the surgeon's hand effectively closes the opening 14, the gas in the abdomen will tend to inflate the interior of the sleeve 2 in the manner of a balloon and no gas can escape  
25           through the opening 14. Thus, the abdomen 31 remains in an inflated condition thereby enabling appropriate surgery or investigative procedures to be carried out.

          In order to enhance the sealing arrangement at  
30           the opening 14 of the device 100, the cuff 23 is provided which, by its nature, tends to be more fully in interengagement with the wrist or arm of the surgeon's hand.



With particular reference to Figure 8 of the drawings, the device 50 may be used in a similar manner to the device 100. However, to even further enhance the sealing arrangement, and with particular reference to  
5 Figure 8 of the drawings, the glove 53 together with the integral flange 52 is employed so that upon insertion of the surgeon's hand into the device 2, the flanges 51 and 51 are in sealing interengagement.

10 So as to further enhance the sealing arrangement at the site of the incision in the abdomen 3 and with particular reference to Fig. 9 of the drawings, following incision and before use of the device 60, the inner ring 63 is inserted into the wound, the outer  
15 ring 64 engages with the opening 5 inside the sleeve 2 with the flange 11 adhesively connected to the abdominal wall or drape as previously described. This arrangement provides for an even more secure sealing arrangement.

20 With reference now to Figures 10-14 of the drawings, following the incision procedures referred to above, the flange 211 is offered and adhered to the abdomen 31 and the peritoneum is cut. Immediately the  
25 sleeve 202 will inflate. However, because of the increase in pressure within the sleeve 202 and surrounding the second sleeve 232, the material of the second sleeve 232 at the opening 238 will be biased together so as to close the opening 238. Because the  
30 end 244 of the tube 245 is in communication with the abdominal cavity, the spur 247 and the end 246 should be closed to prevent the escape of gases from the cavity.

Upon insertion of the surgeon's hand 300 through the cuff 221, the gas within the sleeve 202 remains in place until the hand 300 passes through the aperture 238 whereupon the gasses enter the second sleeve 232.

5 However, because the cuff 221 provides an effective seal around the surgeon's arm, gasses cannot escape any further and the abdominal cavity does not collapse. Access to the abdominal cavity via the opening 205 can now take place. Upon withdrawal of the surgeon's hand  
10 through the aperture 238 and then through the opening 214, gasses will escape from the second sleeve 232 but as soon as there is the resulting fall in pressure in the second sleeve 202, the opening 238 will close and the pressure maintained within the abdominal cavity.  
15 Essentially, therefore, the material of the second sleeve 232 at the opening 238 provides a third sealing means which together with the first sealing means define a substantially gas tight chamber or second sleeve 232 in communication with the opening 238.

20

If desired, instruments may be inserted through the apparatus 200 in place of a hand 300 under the same operating conditions. If desired, carbon dioxide gas may be insufflated through the tube 245 and into the  
25 abdominal cavity.

There are many advantages of the invention. Because a surgeon need only make a relatively small incision the trauma to the patient is minimised, there  
30 is less risk of damage to the immune system and the healing time is short with a consequent decrease in the length of the hospital stay required. The techniques are considerably simpler than conventional laparoscopic surgical techniques and can be readily performed by a  
35 surgeon with minimal additional training. A wide range

of operations can be performed using the apparatus of the invention. The surgeon is already trained to perform conventional surgery using his hand. The transition to assisted surgery is relatively easy.

5

It is anticipated that in some cases adhesive may be applied to a patient around the area of an incision to which a sealing ring of the sleeve is to be attached during preparations for an operation. Adhesive  
10 may alternatively or additionally be applied to the ring to be attached around the area of an incision. Either or both layers of adhesive may be covered by a sterile wrapping material through which the incision may be made. Either or both layers of adhesive may be  
15 provided with peel-off covers.

The inner flange with ring protects the wound and reduces gas release. It also enhances pneumoperitoneum.

20

It will further be appreciated that the sleeve may incorporate an air lock to facilitate changing of an instrument and/or debris such as cancer cells during an operation without breaking the sterilised  
25 environment in the sleeve.

The inner walls of the sleeve or sleeves may incorporate a self-lubricating layer to reduce friction coefficient.

30

The sleeve (or sleeves) is designed to use both arms if the surgeon requires this.

**CLAIMS:**

1. An apparatus for use in surgery comprising a sleeve having an entry opening and exit opening;  
5 a first sealing means for sealing the exit opening around an incised wound of a patient;  
a second sealing means for sealing the entry opening so as to enable a controlled environment within the sleeve to be maintained in use.
- 10 2. An apparatus as Claimed in Claim 1 or Claim 2 wherein the sleeve is of a gas-impermeable preferably flexible material, to enable a controlled pressurised environment within the sleeve to be maintained and  
15 which apparatus may optionally comprise a protector means insertable in the wound.
3. An apparatus as claimed in Claim 2 wherein said protector comprises a first ring and a second ring  
20 integral with, and interconnected by, a tube wherein, in use, the first ring is insertable into the wound, the second ring is locatable inside the sleeve so as to form a sealing arrangement between the body and the sleeve.
- 25 4. An apparatus as claimed in any of Claims 1-4 further comprising a second sleeve disposed within the sleeve, said second sleeve having a first opening and a second opening; the first opening being locatable  
30 inside the sleeve being in a normally closed condition and capable of being in an open condition inside the sleeve; the second opening being in communication with the entry opening; the first opening providing a third sealing means which together with the first sealing

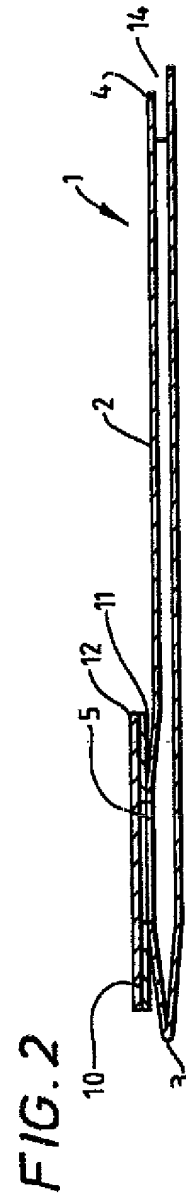
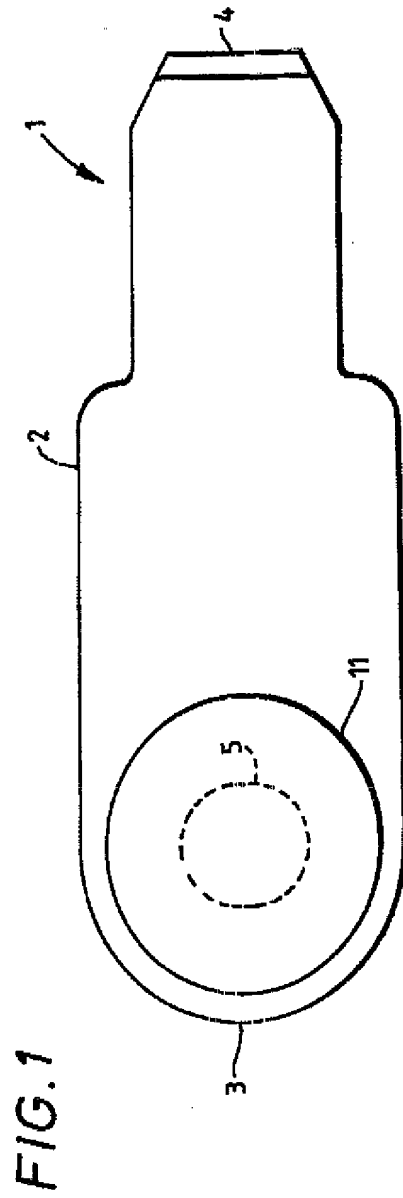
means defines a substantially gas tight chamber in communication with the exit opening.

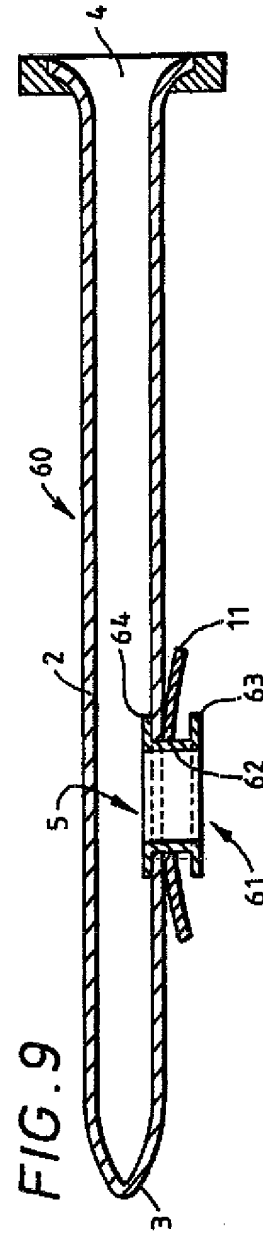
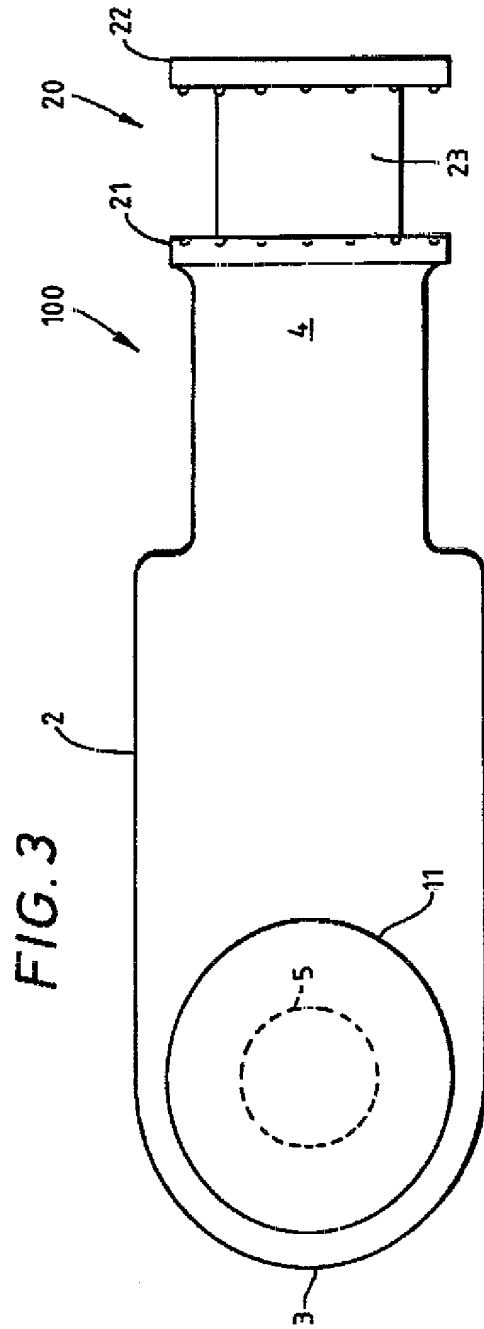
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5. An apparatus substantially as hereinbefore described with reference to and as illustrated in the accompany drawings.

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FIG. 4

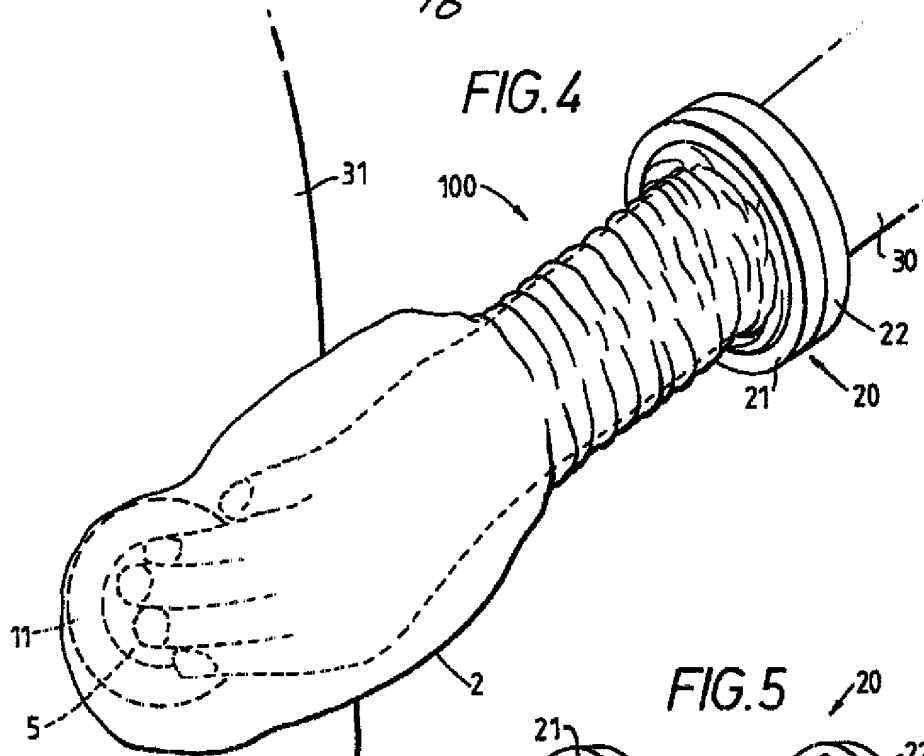


FIG. 5

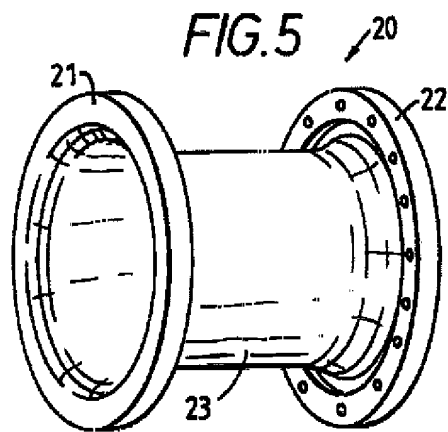


FIG. 6

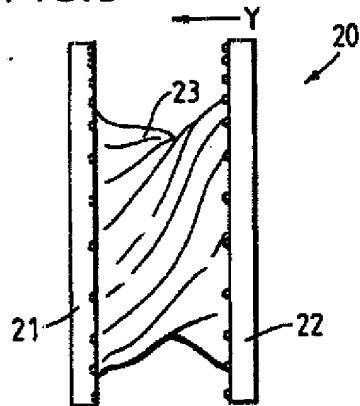
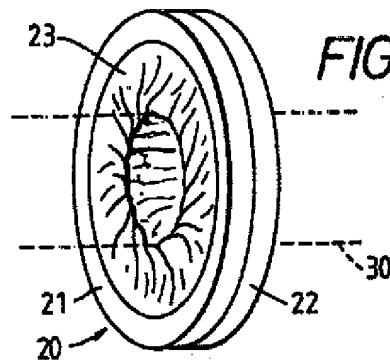


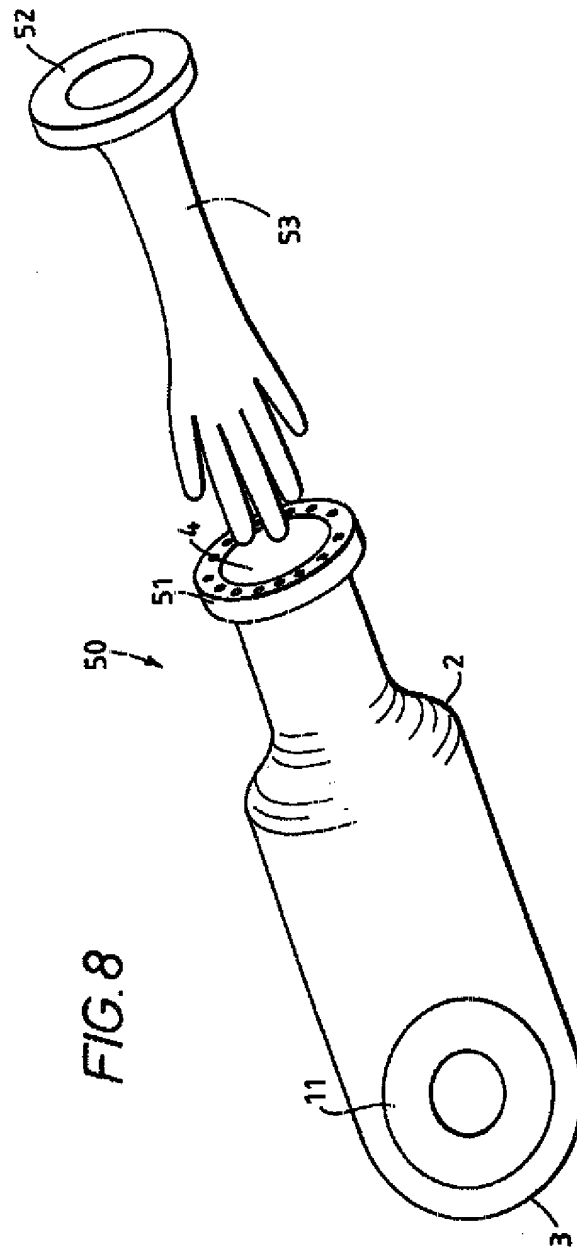
FIG. 7





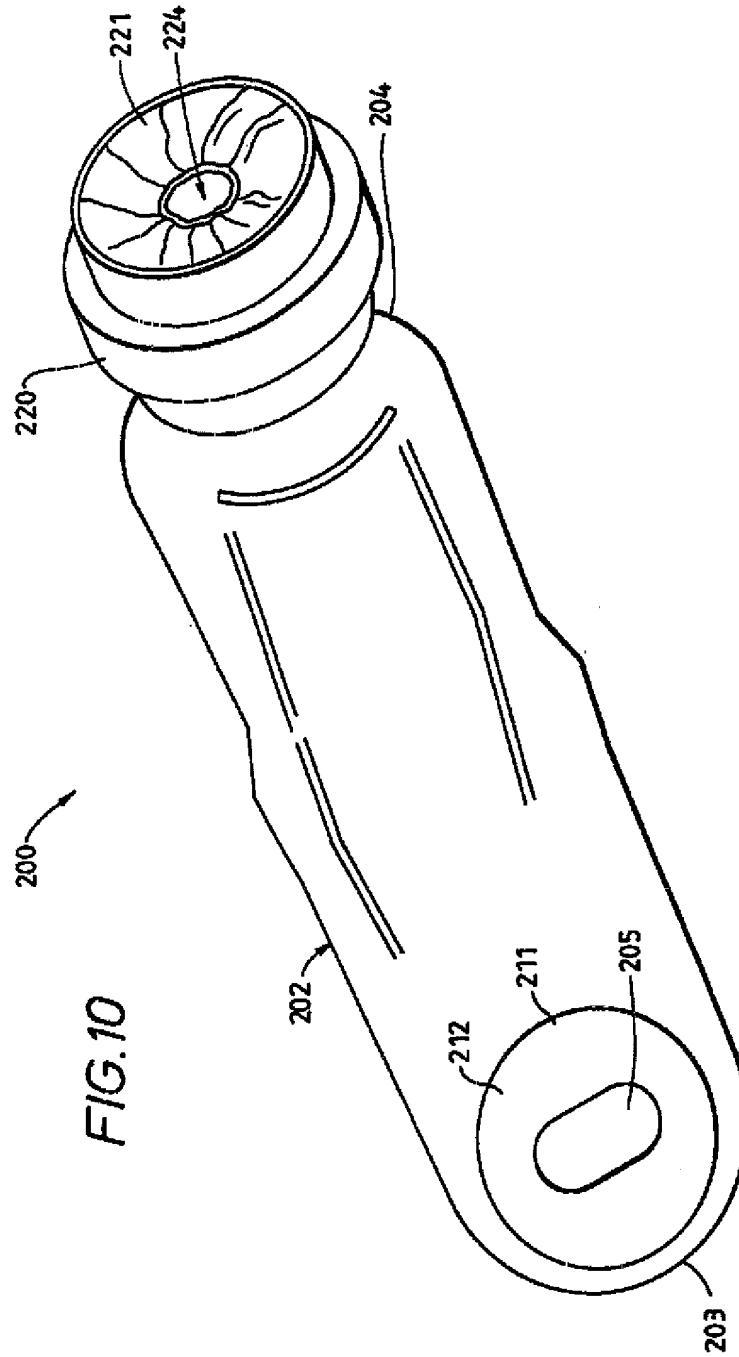
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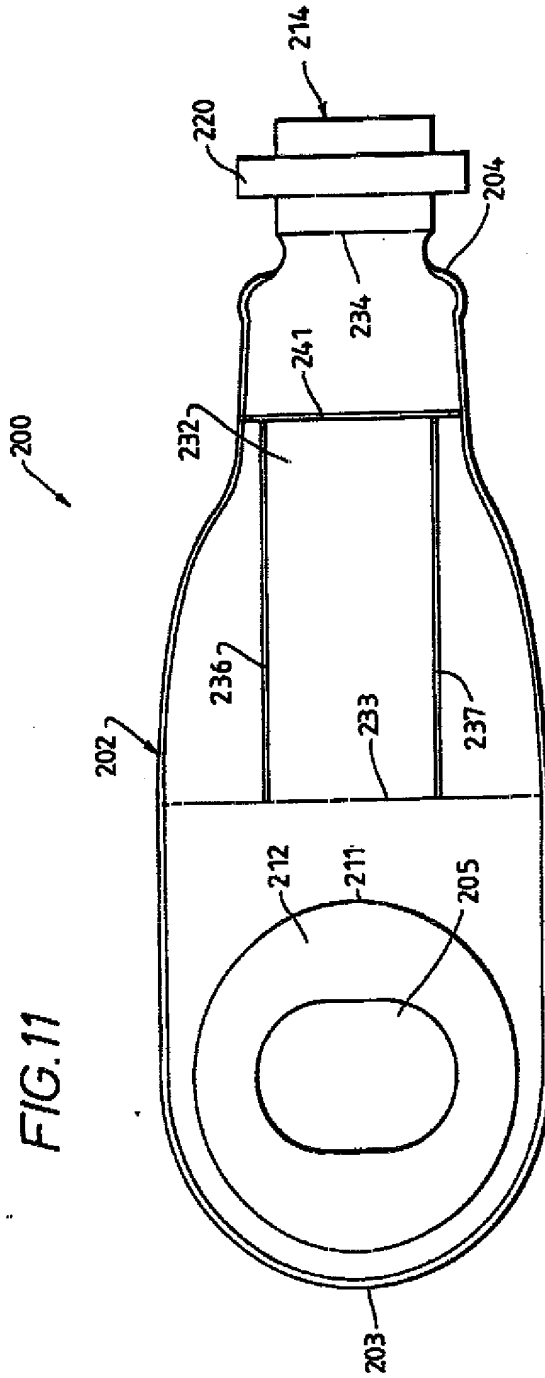


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